



Cluster On Anaerobic digestion environmental Services and nutrients removal

## 1<sup>st</sup> COASTAL Biogas Conference

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Malmö, Sweden



### Partners



Universität  
Rostock



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## Background and goal of the conference

As part of the COASTAL Biogas project conferences are organised in order to spread the knowledge on the project as well as collaborate with other projects. The first conference was held in Malmö, Sweden. Information on the future conferences will be available on the website: <https://www.coastal-biogas.eu/events/>.

### *Eutrophication in the Baltic Sea*

Eutrophication affects 97% of the Baltic Sea. Combined with other problems, such as noise, pollutants and litter it creates a dangerous cocktail of negative effects, which put stress on the species living in the Baltic Sea, which are already under stress since they have to cope with the living in the brackish water. Coastal area is the most valuable and vulnerable. Effects in the coastal areas are felt throughout the water.

A good summary of the effects of Eutrophication can be found on the Helcom (Baltic Marine Environment Protection Commission - Helsinki Commission) website: <http://www.helcom.fi>.

### *Challenges and Benefits of Seaweed Collection and Utilisation for AD*

Several projects with seaweed collection and even biogas production were started as early as the 1980's. Their aim was to turn the problem of cast seaweed into a resource. Several projects have since been carried out, which have built upon this knowledge, but there is still much more knowledge required, in order to identify the most holistic approaches.

**Challenges**, which were discussed at the 1<sup>st</sup> COASTAL Biogas Conference included:

- Main issues for use of seaweed as a substrate
  - Minimising sand content
  - Separation of plastic, metal, etc.
  - Seaweed should be as fresh as possible
- Issues with collection
  - Salt → saltwater is corrosive to the machinery and can be an inhibitor in the biogas process
  - Sand → sand is a problem for machinery and can accumulate in the fermenter at the biogas plant and cause problems
  - Cadmium → content varies depending on current growth rates of seaweed; typically lower in late spring to early autumn.

**Benefits** of collection and AD treatment

- Reduction of the inconveniences with rotten seaweed (smell, flies, toxicity, access to water etc.)
- Removal of nitrogen and other excess nutrients from the Baltic Sea
- Production of a high-quality fuel (biogas) and fertiliser

Two plants were introduced, which use or have used seaweed as a substrate, Solrød biogas plant (Denmark) and Smyge biogas plant (Sweden). The Solrød district had a problem with smell from the seaweed and the algae on the beach. Several solutions were attempted, but failed. The biogas plant proved to be the best solution and began production in 2015. The Smyge plant used algae as a substrate as part of the WAB (wetlands, algae, biogas) project.

**General observations** are that sand content can be reduced by collecting in the water or washing the seaweed with a grate in the shallow water after collecting it from the beach area. In order to determine the best possible collections techniques, it is best to inspect the beach sediment as well as adapt machinery so that it can handle large amounts of algae and salt.

**Pre-treatment** at the plant will still be necessary to reduce the sand content further. Size reduction is recommendable for wet fermentation. Solrød has a tank with a very strong stirrer, which separates sand and seaweed. The sand can then be removed from the bottom of the tank.

Some of the first algae fermentation tests were carried out with algae as the sole substrate. It was observed that this was not a good idea due to several factors:

- Process was unstable due to sulfides
- Sampling was irregular due to the fluctuating occurrence of cast seaweed
- Content of sand was high, which caused mechanical problems

Questions, which were posed at the Smyge biogas plant:

- How to stabilise the project without chemicals? One solution was co-digestion.
- Can the fertiliser be used in agriculture? In some charges the cadmium was too high, depends on time of year. If levels are low it is usable.
- What is the most efficient/cost-effective way to collect the seaweed? Washing remains a very viable option due to the cost. Other attempts, such as a rotating drum, were too difficult/expensive. Another promising method is with a boat-like collection machine called a Truxor. It has yet to be demonstrated under realistic conditions and was developed for smaller water bodies without some of the challenges of the Baltic Sea, such as waves.

### ***The COASTAL Biogas Project***

The COASTAL Biogas project aims to build on information gained in the past projects, such as WAB (Wetlands, Algae, Biogas), and collaborate with newer projects, such as CONTRA and GRASS. The result: turning problems into potential for the Baltic Sea region and environment - reducing eutrophication, creating renewable energy and high-quality bio-fertilisers from unwanted waste, making it easier to keep beaches clean and inviting for the region's vital tourism industry and at the same time contribute to the transition to a circular bio-economy.

The project is funded by the Interreg South Baltic Programme and consists of 6 partners from 5 Baltic countries and 11 Associated Partners. Sustainable potential for each region will be identified and policy framework overview along with suggestions for policy adaptations will be provided.

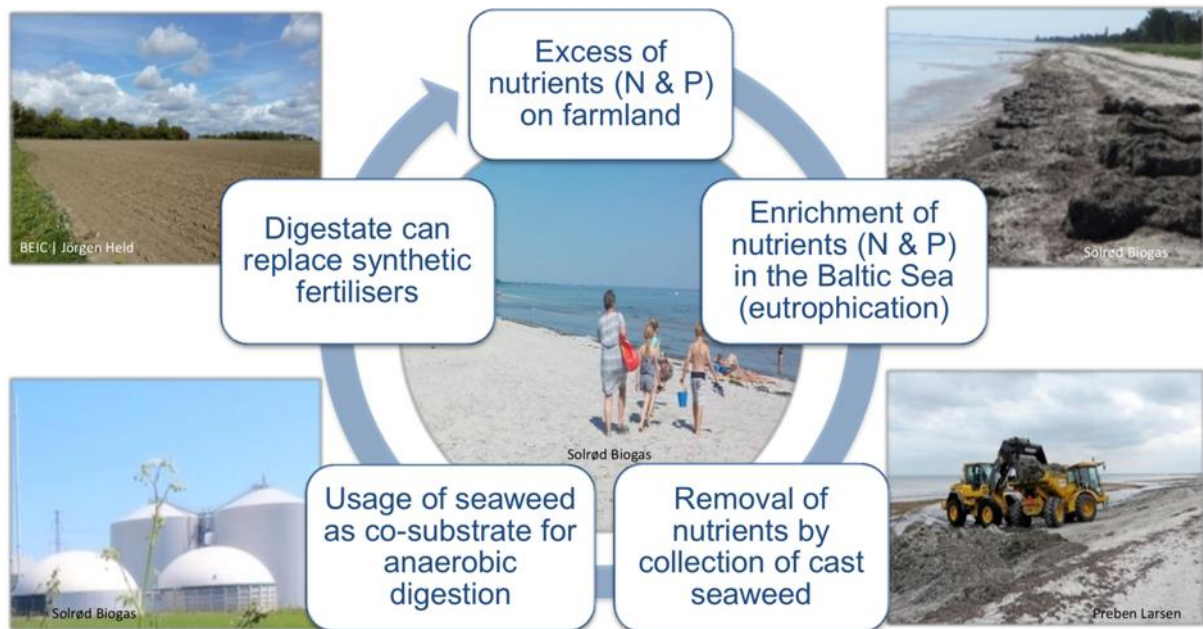


Figure 1: The circular bioeconomy aspects addressed with the COASTAL Biogas project. Source: Presentation from COASTAL Biogas coordinator, Anne Roßmann, available at <https://www.coastal-biogas.eu/events/conference-sweden/>

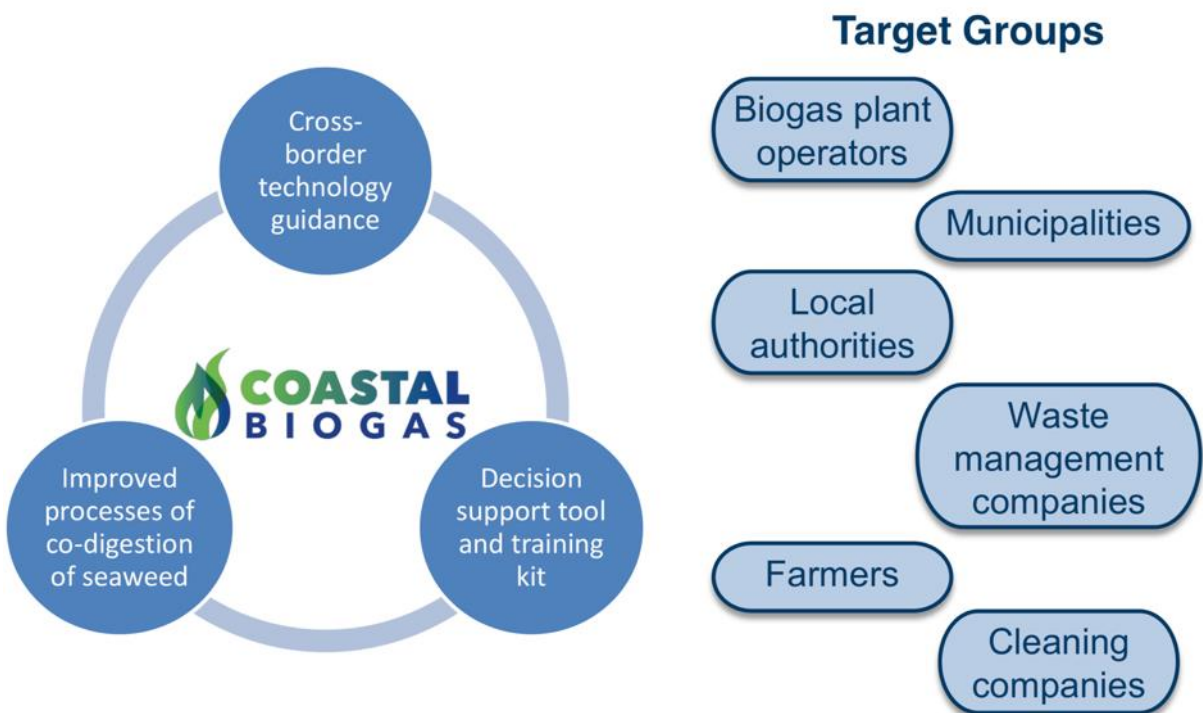


Figure 2: Goals and target groups of the COASTAL Biogas project. Source: Presentation from COASTAL Biogas coordinator, Anne Roßmann, available at <https://www.coastal-biogas.eu/events/conference-sweden/>

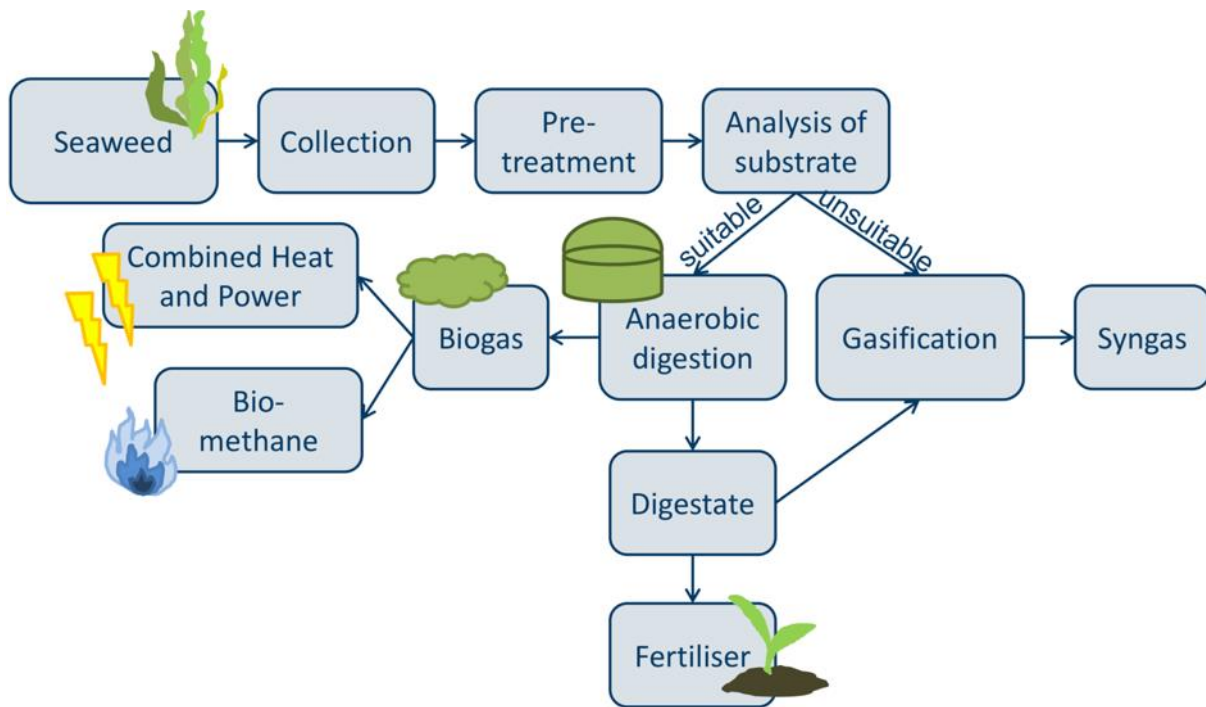


Figure 3: The scope of the technological chain being evaluated in the COASTAL Biogas project. Source: Presentation from COASTAL Biogas coordinator, Anne Roßmann, available at <https://www.coastal-biogas.eu/events/conference-sweden/>

### Approaches from other regions – the Black Sea in Romania

Sandor Bartha from BIO-C Green Energy Association presented some concepts from the Black Sea in Romania. The tourist season in Romania is relatively short – end of May to mid-September. Around 30,000 t of algae are typically collected around that time. Analysis showed that the composition was around 95% algae and seaweed and 5% mussels/clams. Several pre-treatment methods were tested, including hydrothermal and mild acid hydrolysis.

Biogas is one of the possibilities for utilisation. Figure 4 shows the pyramid for potential use, which was presented. The potential given at the top represents applications that require high quality seaweed and smaller amounts. Biogas is at the base of the pyramid because it requires larger quantities, but the quality requirements are much lower than for cosmetics and medical applications.



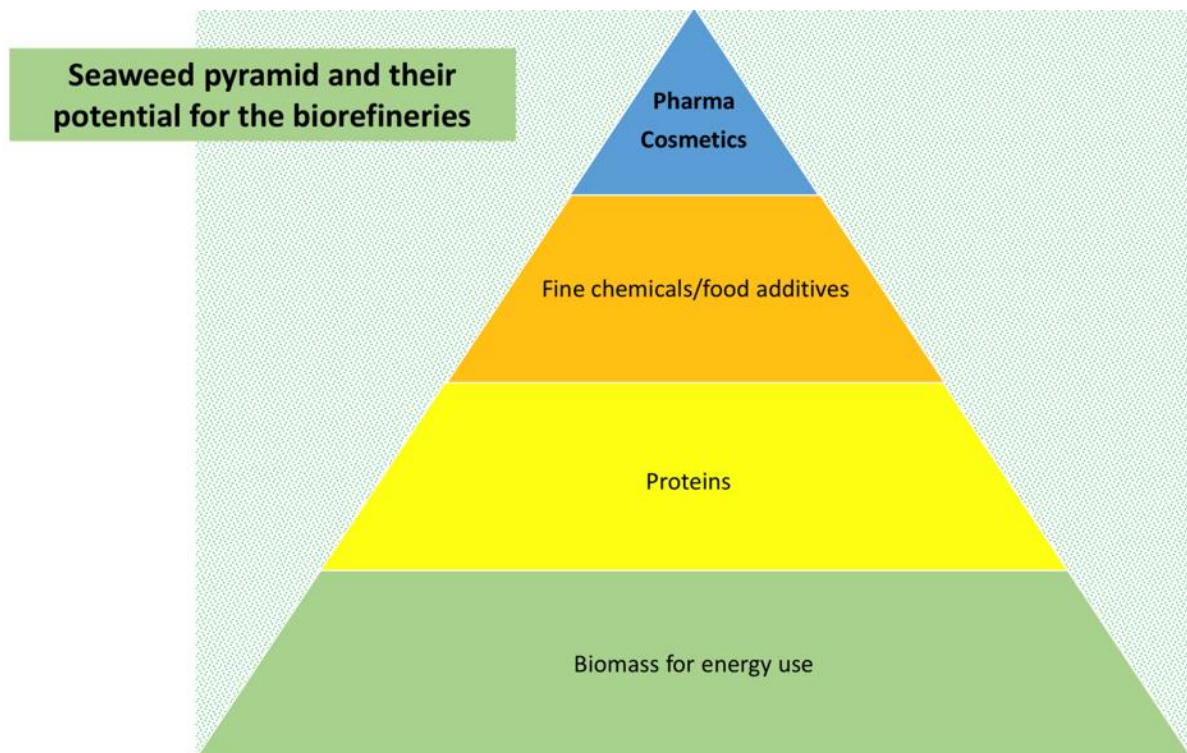


Figure 4: Suitable uses for seaweed depending on quality and price – high quality / small quantities at the top and lower quality / large quantities at the base. Source: Presentation from Sandor Bartha available at <https://www.coastal-biogas.eu/events/conference-sweden/>

### ***Tourism and Nature – Finding a Balance***

Beach wrack is often regarded as nuisance by tourists and residents in coastal areas. Since tourism is often a significant industry in the regions the municipalities have a great interest in maintaining the areas and keeping them pleasant for visitors. The large quantities of cast seaweed also involve high costs for collection.

It is important to find a balance between “clean” beaches, environmental protection and the economy. As pointed out by some of the conference participants, the seaweed may represent excess nutrients, which are being removed, but in some cases they may also be important for some species, such as some birds. How can we establish guidelines for when and how we can collect the seaweed? Some questions that should be investigated:

- Where is the wrack typically?
- How much beach width should be cleaned?
- How do we determine the characterisation of contents?

### ***Policy Work and the Value of Social Benefits of Biogas***

It is important to make it clearer that biogas is circular economy. It also provides social benefits and two studies (ENEA Consulting, *Revue des externalités positives de la filière biométhane*, 2019; EBA Proposal for National Biogas Strategy 2.0, Sweden, April 2018) have quantified the benefit to be between 35 – 75 € per MWh of energy production.

The social benefits of biogas include:

- Climate benefit
- Improved air quality
- Value of plant nutrients
- Increased employment
- Increased security of supply of energy
- Increased resource of retentions with food supply

The fact that banks are also beginning to take climate-relevant factors in general into consideration for investments is also promising and appears to reflect a change in perception that is urgently needed.

### ***Certification of digestate as a foundation for business***

Sweden has developed a certification system for digestate, which is helpful for boosting the business of selling it to farmers. It creates a high confidence in the product and is considered as a 'license to operate'. The question was posed if analysis of the output is more relevant or the analysis of the input or rather the chain of production for the digestate.

### ***Issues to be Addressed for the Collection and Use of Seaweed in AD***

In the final panel discussion with **Ann-Marie Camper, Prof. William Hogland, Anders Mathiasson and Bjørn Tore Erdal** the main topic was challenges that need to be faced for the collection and use of cast seaweed:

- **Hogland** - We must learn much more about the seaweed and the seasonal differences. There must be more cooperation with biologists. We need to consider new methods for technical issues, such as saltwater for machinery.
- **Camper** – The collection phase should be combined with raising awareness for the environmental problems in general. Investigation to identify vulnerability especially in the case of harvesting offshore. Legal aspects should be considered. Municipality owns very little of its shore, otherwise private property.
- **Mathiasson** – It is important to consider logistics and costs as well as identify other benefits.
- **Erdal** – Development as an industry is needed rather than as a municipal task.

### ***Study Tour to Jordberga Biogas Plant***

The conference participants visited the Jordberga biogas plant near Trelleborg, Sweden. The plant has once used mainly energy crops, but has been switching more and more to waste from the food industry. The plant belongs to the Finnish gas company, Gasum, and upgrades its biogas to biomethane, which is fed to the gas grid.

The biogas plant is one of the largest in Sweden with an annual capacity of 110 GWh. The biogas is upgraded to natural gas quality by means of water scrubbing and injected into the high pressure gas grid.



*Figure 5: Study tour to Jordberga biogas plant – discussion in front of the administrative building, which is a remnant of the sugar beet factory that was once located at the site.*





*Figure 6: Study tour to Jordberga biogas plant – view of the three main fermenters.*

## ACKNOWLEDGMENTS

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